

# A Turbo-Brayton Cryocooler for Aircraft Superconducting Systems, Phase II

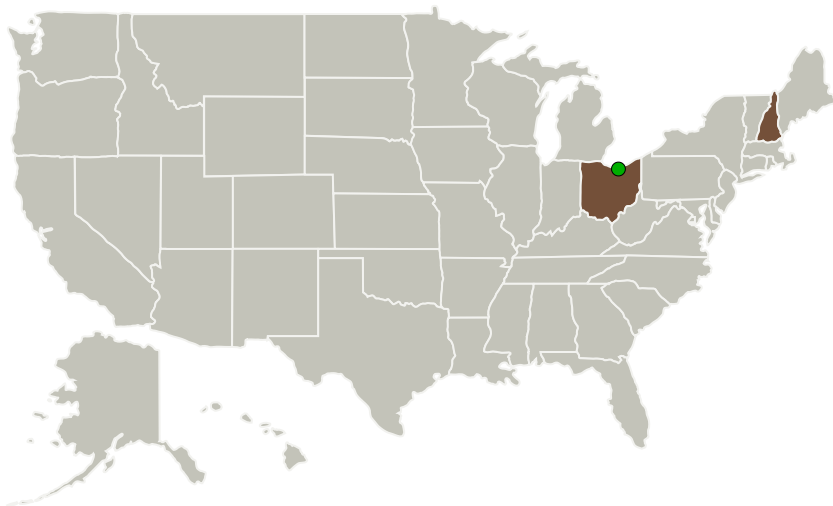
Completed Technology Project (2013 - 2015)



## Project Introduction

Hybrid turboelectric aircraft with gas turbines driving electric generators connected to electric propulsion motors have the potential to transform the aircraft design space by decoupling power generation from propulsion. Resulting aircraft designs such as blended-wing bodies with distributed propulsion can provide the large reductions in emissions, fuel burn, and noise required to make air transportation growth projections sustainable. The power density requirements for these electric machines can only be achieved with superconductors, which in turn require lightweight, high-capacity cryocoolers. We have developed a Cryoflight turbo-Brayton cryocooler concept that exceeds the mass and performance targets identified by NASA for superconducting aircraft. In Phase I of this project, we extended our initial design study and developed modeling tools to support system-level optimization and individual component designs. We focused on the critical component for mass reduction – the recuperative heat exchanger – and performed risk reduction activities to demonstrate the feasibility of our concept for this component. In Phase II, we will design, build, and test two compact lightweight, high-performance recuperators for the Cryoflight cryocooler. This development effort will provide an enabling technology for the superconducting systems needed for hybrid turboelectric aircraft to be feasible.

## Primary U.S. Work Locations and Key Partners



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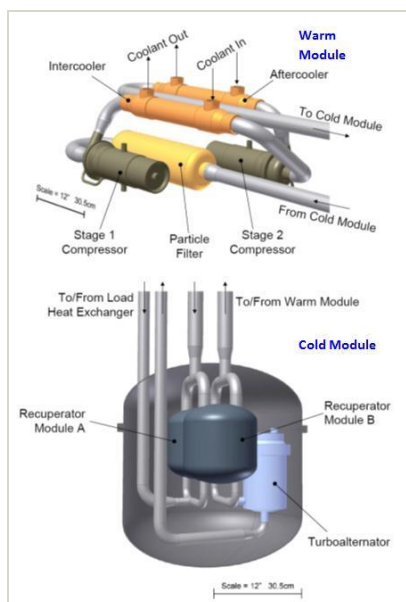


Organizations Performing Work	Role	Type	Location
Creare LLC	Lead Organization	Industry	Hanover, New Hampshire
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

## Primary U.S. Work Locations

New Hampshire	Ohio
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## Images



## Briefing Chart

A Turbo-Brayton Cryocooler for Aircraft Superconducting Systems, Phase II  
(<https://techport.nasa.gov/image/127503>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Creare LLC

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

Mark Zagarola

### Co-Investigator:

Mark Zagarola

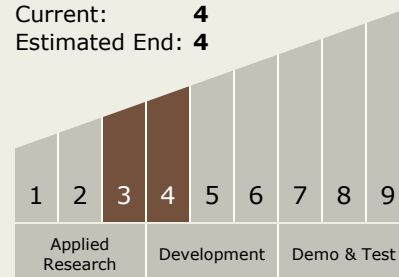
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## Technology Maturity (TRL)

Start: **3**  
Current: **4**  
Estimated End: **4**



## Technology Areas

### Primary:

- TX14 Thermal Management Systems
  - └ TX14.1 Cryogenic Systems
    - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System